CLAIMS

1. A read head protection circuit, for discharging electric charges accumulated on a component of a read head, the read head having at least a substrate, at least one magnetic shield and at least one sensor element, including:

at least one parasitic shield placed in close proximity to the magnetic shield; and

means for maintaining the at least one parasitic shield substantially at an electrical potential of the sensor element.

2. The read head protection circuit of claim 1, wherein the at least one parasitic shield and the at least one magnetic shield is formed from substantially the same material.

3. The read head protection circuit of claim 1, wherein the means for maintaining the at least one parasitic shield at essentially the electrical potential of the sensor element includes a resistor coupled between the parasitic shield and sensor element.

4. The read head protection circuit of claim 1, wherein an electrical potential required to cause a sparkover between the magnetic shield and the sensor element is greater than an electrical potential required to cause a sparkover between the parasitic shield and the magnetic shield.

5. The read head protection circuit of claim 4, wherein the electrical potential required to cause a sparkover between the magnetic shield and the substrate is greater than the electrical potential required to cause a sparkover between the magnetic shield and the parasitic shield.

6. The read head protection circuit of claim 1, further including an electro-static discharge circuit electrically coupled between the magnetic shield and the parasitic shield.

7. The read head protection circuit of claim 6, wherein the electro-static discharge circuit includes at least one active device.

8. The read head protection circuit of claim 7, wherein the at least one active device is a transistor.

9. The read head protection circuit of claim 6, wherein the electro static discharge circuit includes at least one passive device.

10. The read head protection circuit of claim 1, wherein the means for maintaining the at least one parasitic shield substantially at the electrical potential of the sensor element includes a circuit element coupled between the parasitic shield and the sensor element,

and wherein an electrical potential required to cause a sparkover between the sensor element and the magnetic shield is greater than the sum of an electrical potential dropped across the diode and an electrical potential required to cause a sparkover between the parasitic shield and the magnetic shield.

11. The read head protection circuit of claim 6, wherein the circuit element is a diode.

12. The read head protection circuit of claim 1, wherein each parasitic shield has a proximal end in close proximity to the magnetic shield, the proximal end having high electric field density inducing structures.

13. The read head of claim 12, wherein the high electric field density inducing structures have a radius of less than about 1μm.

14. The read head of claim 1, wherein the sensor element is a magneto-resistive sensor element.

15. A method for manufacturing a read head protection circuit within a read head on a substrate, including the steps of:

applying a first gate structure to the substrate;

applying a layer of removable material over the first gate structure;

removing a portion of the removable material which is not coplanar with a plane that is parallel to an interface between the substrate and the insulator;

removing the first gate structure;

applying material to form a first magnetic shield and a first and second parasitic shield.

16. A method for manufacturing a read head protection circuit within a read head having at least one magnetic shield, and at least one sensor element, including the following steps, performed on a substrate:

applying a first layer of insulating material;

applying a first gate structure;

applying a layer of removable material over the first gate structure;

removing a portion of the removable material which is not coplanar with a plane that is parallel to an interface between the substrate and the insulator;

removing the first gate structure such that at least one vertical wall remains;

applying material to form a first magnetic shield and at least a first parasitic shield; and

removing excess material from the surface of the first magnetic shield and each parasitic shield, such that there is no conductive path between the first magnetic shield and any of the parasitic shields.

17. The method of claim 16, further including the following steps performed on the substrate:

applying a second layer of insulating material over the first magnetic shield and each parasitic shield;

applying material to form a sensor element over the second layer of insulating material;

applying a third layer of insulating material over the sensor element;

applying material to form a second magnetic shield and a third and fourth parasitic shield;

applying a second gate structure;

applying a layer of removable material over the second gate structure;

removing that portion of the removable material which is not in a coplanar to plane that is parallel to the substrate/insulator interface;

removing the second gate structure;

applying material to form a second magnetic shield and a third and fourth parasitic shield; and

removing excess material from the surface of the second magnetic shield and the third and fourth parasitic shield, such that there is no conductive path between the second magnetic shield and either the third or fourth parasitic shield.

18. A read head protection circuit, for discharging electric charges accumulated on a component of a read head, the read head having at least a substrate, at least one magnetic shield and at least one sensor element, including: at least one spark gap device, having a proximal end electrically coupled to the magnetic shield, and a distal end formed in close proximity to the substrate.

19. The read head protection circuit of claim 18, wherein the distal end of at least one of the at least one spark gap devices has at least one high electric field density inducing device.

20. The read head protection circuit of claim 18, wherein the proximal end of at least one of the at least one spark gap devices is coupled to the sensor element.

21. A read head protection circuit, for discharging electric charges accumulated on a component of a read head, the read head having at least a substrate, at least one magnetic shield and at least one sensor element, the read head protection circuit including:

at least one electrically conductive stud coupled to the substrate;

at least one spark gap device, having a proximal end electrically coupled to the magnetic shield, and a distal end formed in close proximity to at least one of the studs.

22. The read head protection circuit of claim 21, wherein the distal end of at least one of the spark gap devices includes at least one high electric field density inducing device.

23. The read head protection circuit of claim 21, wherein the proximal end of at least one of the spark gap devices is coupled to the sensor element.

24. A data storage system including:

a magnetic storage medium for recording of data along data tracks;

a magnetic transducer maintained in a closely spaced position relative to the magnetic storage medium during relative motion between the magnetic transducer and the magnetic transducer including:

a magnetoresistive sensor including;

a substrate having at least one layer of insulating material;

a magnetic shield disposed within the insulating material;

at least one sensor element disposed within the insulating material;

a transducer protection circuit disposed within the insulating material, for discharging electric charges accumulated on a component of the magnetic transducer, including:

at least one parasitic shield placed in close proximity to the magnetic shield; and

means for maintaining the at least one parasitic shield substantially at an electrical potential of the sensor element;

actuator means coupled to the magnetic transducer for moving the magnetic transducer to selected data tracks on the magnetic storage medium; and

detection means coupled to the magnetoresistive sensor responsive to magnetic fields representative of data bits recorded in the magnetic storage medium intercepted by the magnetoresistive sensor.

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